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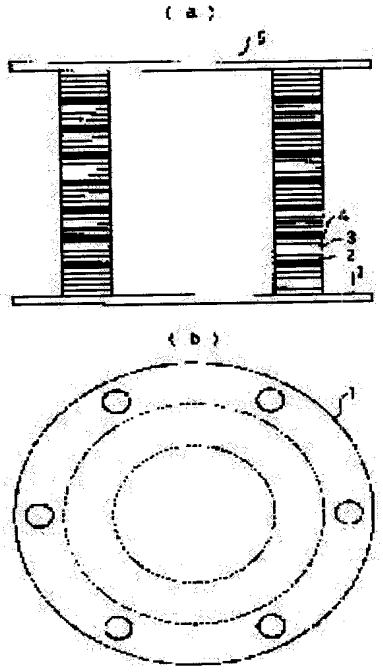
(54) FLEXIBLE DEMOUNTABLE SUPPORT

(57)Abstract:
PURPOSE: To secure shearing rigidity allowing a deformation by laminating rubbers and steel plates into an internally hollow column shape having intermittent faces, pinching it with thick steel plates, and fitting end plates to be fitted to a structure at both the upper and lower ends of the laminated rubbers.
CONSTITUTION: Ring-like thin rubbers 2 and thin steel plates 3 are laminated into an internally hollow shape, it is pinched by upper and lower thick steel plates 4, and multiple blocks are stacked and pinched by upper and lower end plates 1 to be fitted to a structure. The thin steel plates 3 are related with the stress transmission applied when the whole support 5 is deformed, and the thin steel plates 3 have an effect to make the rubber layers 2 thin. The vertical load yield strength and bending rigidity are secured by the thick steel plates 4, and the flexible shearing rigidity allowing a large deformation can be realized by the lamination of the thin rubber layers 2 and the thin steel plates 3.



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CLAIMS

[Claim(s)]
[Claim 1]Flexible bearing which set a predetermined interval among these laminated steel plates, arranged a steel plate thicker than a steel plate of other layers in a columnar rubber body characterized by comprising the following which laminated steel plate of each other, and was characterized by things.
A thin rubber layer which has a closed section of internal hollow.
Similarly it is a closed section of internal hollow.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to bearing which supports the dynamic vibration reducer for support bearing for vibration control, such as a building construction and a mechanical apparatus, or vibration control.
[0002]
[Description of the Prior Art]Conventionally, laminated rubber support is variously developed for such the purpose. the Nikkei architecture "which "base-isolation-building" model institutions which made civilization declaration appear all at once" July 14, 1986 item. The most general thing as laminated rubber support of the 54th page - the 75th page referring-to-former has some which carried out lamination pinching of thin rubber and griddle by turns between the end plates of the upper and lower sides for attaching to a structure. Drawing 7 is a figure of the conventional rubber bearing of the internal fullness type of a cylindrical shape. However, if comparatively lightweight structures, such as a wooden building structure thing, a mechanical apparatus, or a dynamic vibration reducer, are made into support ****** using internal fullness type bearing with the same degree of vertical stress as the case of weight load where it is large, it will become small small bearing of a cross-section area, and horizontal allowable deformation will become small. Drawing 8 (a) and (b) is a figure showing the inconvenient point at the time of supporting a small structure by conventional-type laminated rubber.
[0003]Thus, when the lightweight structure was supported using internal fullness type rubber bearing, horizontal permissible modification was small, and there was difficulty in realizing the own natural period of a long period.
[0004]Then, the inside of a cylindrical shape was made hollow, horizontal shear rigidity was made small, and what heightened horizontal deformation capacity was developed. Drawing 9 (a) is a figure of the fundamental thing of the rubber bearing which laminated rubber and a

griddle to ring shape and made the inside hollow. However, although shear rigidity becomes small and the laminated rubber support which made the inside hollow demonstrates big deformation capacity, opposite side flexural rigidity and vertical-load proof stress decline, and are not preferred. In order to solve this problem, it applies to sliding direction both ends, for example from the sliding direction center section of laminated rubber, Two or more sets of laminated rubbers of the thing (JP,5-141463,A) which extends the ring width in a horizontal section continuously, and cannot be buckled easily, or hollow are accumulated on a sliding direction via a joint plate, and there are some (JP,5-141464,A) etc. which acquire predetermined low shear rigidity. However, it becomes complicated [the thing of JP,5-141463,A] processing it, and the proportion of a path and height becomes longwise [the thing of JP,5-141464,A], and we are anxious about the fall of the flexural rigidity as bearing. In addition, there is the method of thickening thickness of the griddle to pinch. By this method, the thickness of rubber becomes thin relatively, the original characteristic of the laminated rubber said that horizontal shear rigidity is small is lost, and it is inconvenient. If rubber thickness is then thickened, the overall height of bearing will become high, and the inconvenience said that flexural rigidity falls is caused. Drawing 9 (b) is a figure of bearing which thickened thickness of the griddle to pinch.

[0005]This invention is devised in order to solve such a problem.

[0006]

[Means for Solving the Problem]In a thin rubber layer which has a closed section of internal hollow, and a columnar rubber body which laminated steel plate of each other which similarly has a closed section of internal hollow, a predetermined interval is set among these laminated steel plates, and let flexible bearing which arranged a steel plate thicker than a steel plate of other layers, and was characterized by things be main point.

[0007]

[Function]Drawing 1 is a figure showing flexible bearing of this invention.

[0008]A thick griddle participates in the stress transfer which acts at the time of modification of this whole bearing, and an effect is demonstrated although a thin griddle makes a rubber layer thin. That is, the rubber layer thin on the other hand which a thick griddle holds the flat surface of a section and secures flexural rigidity, and the alternation of strata of a thin griddle improve the rigidity of the perpendicular direction, and realize horizontal low shear rigidity.

[0009]Drawing 2 is a figure showing a state in case flexible bearing of this invention carries out horizontal deformation.

[0010]Since the flexural rigidity of a thick griddle is high and the alternation-of-strata portions of thin rubber and a thin griddle have low shear rigidity, this bearing causes horizontal deformation in the form where the flat surface was held on the whole. Since rubber is divided by the thin griddle, the longitudinal elastic modulus of bearing is high and vertical-load proof

stress is improving. Stable load bearing is realized by operation of these both sides.

[0011]Drawing 3 is a figure showing a state in case the conventional bearing which consists of a rubber layer and alternation of strata of a thin griddle in hollow carries out horizontal deformation. The rigidity of a griddle is low, therefore load bearing where the flexural rigidity as bearing was stabilized deficiently is difficult for it. Since surrender of a steel plate also takes place at an early stage, proof stress also declines.

[0012]

[Example]It is based on a figure below and flexible bearing of this invention is explained.

[0013]Drawing 1 (a) is a sectional elevational view of flexible bearing of this invention, and (b) is a plan. The block which inserted into ring shape the upper and lower sides of what carried out alternation of strata of the thin griddle 3 to the thin rubber 2 by the thick griddle 4 is accumulated two or more sets so that it may become internal hollow, and it is considered as the structure which was attached to the structure and pinched with the end plate 1 of the upper and lower sides of business.

[0014]For example, outer diameter phi600mm, inside diameter phi360mm, and 2-3 mm in thickness of rubber, 3-4 mm in thickness of a thin griddle, and 15-20 mm in thickness of rubber and a thin alternation-of-strata block of a griddle. 9-12 mm in thickness of a thick griddle and the longitudinal elastic modulus of bearing by flexible bearing with an overall height of 1200 mm serve as about 600 to 700 kg/cm^2, and it is only causing about 2-cm perpendicular modification to the supporting load of 25Ton. On the other hand, horizontal rigidity is about 50 to 100 Kgf/cm, and can be supported with the cycle of 3 to 5 seconds to supporting load 25Ton. It is thought that the horizontal deformation of **** flexible bearing can hold a linear state to around **50 cm.

[0015]

[Effect of the Invention]According to this invention, a thick griddle participates in the stress transfer which acts at the time of modification of this whole bearing, and an effect is demonstrated although a thin griddle makes a rubber layer thin. That is, vertical-load proof stress, the rubber layer thin on the other hand for which flexural rigidity is secured, and the alternation of strata of a griddle with a thick thin griddle can realize pliant shear rigidity which permits big modification.

[0016]Therefore, in order to be able to realize a comparatively lightweight dynamic vibration reducer (vibration control device of a highrise building) as a system with the own natural period for 3 to 5 seconds and to absorb vibrational energy by the deformability, in vibration of a long period, a wind shake etc. are very effective comparatively. Drawing 4 is the figure which applied flexible bearing of this invention to the dynamic vibration reducer installed in the highrise building.

[0017]Since shear rigidity is low also as base isolation bearing of lightweight buildings made

conventionally impossible, such as a timber building, it is applicable enough. Drawing 5 is the figure which applied flexible bearing of this invention to the timber building.

[0018]Bearing of this invention is applicable also to the floor quake-absorbing which installs machinery apparatus.

[0019]Drawing 6 is the figure which applied bearing of this invention to quake-absorbing [of floors, such as a computer lab,].

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1](a) is a sectional elevational view of flexible bearing of this invention, and (b) is a plan.
[Drawing 2]It is a figure showing a state in case flexible bearing of this invention carries out horizontal deformation.
[Drawing 3]The conventional bearing which consists of a rubber layer and alternation of strata of a thin griddle in hollow is a figure showing a state when carrying out horizontal deformation.
[Drawing 4]It is the figure which applied flexible bearing of this invention to the dynamic vibration reducer installed in the highrise building.
[Drawing 5]It is the figure which applied flexible bearing of this invention to the timber building.
[Drawing 6]It is the figure which applied bearing of this invention to quake-absorbing [of floors, such as a computer lab,].
[Drawing 7]It is a figure of the conventional rubber bearing of the internal fullness type of a cylindrical shape.
[Drawing 8](a) and (b) are the figures showing the inconvenient point at the time of supporting a small structure by conventional-type laminated rubber.
[Drawing 9](a) is a figure of the fundamental thing of the rubber bearing which laminated rubber and a griddle to ring shape and made the inside hollow. (b) is a figure of bearing which thickened thickness of the griddle to pinch.
[Description of Notations]
1 [... A thick griddle,] ... An end plate, 2 ... Laminated rubber, 3 ... A thin griddle, 4 5 [... A small structure, 9 / ... A dynamic vibration reducer, 10 / ... A skyscraper, 11 / ... A lightweight building, 12 / ... A computer, 13 / ... Base isolation floor] ... Flexible bearing of this invention, 6 ... The conventional rubber bearing, 7 ... A large sized structure, 8

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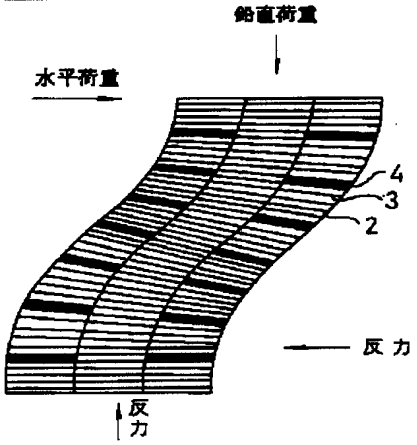
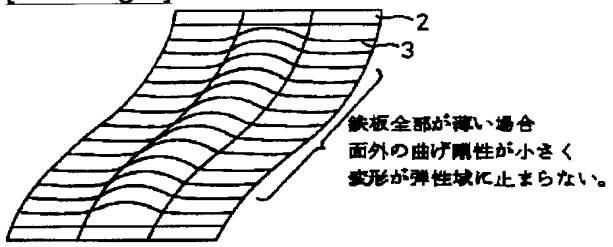
DRAWINGS

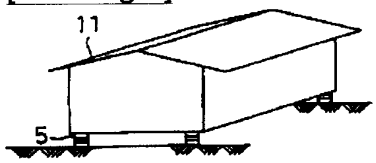
[Drawing 2]



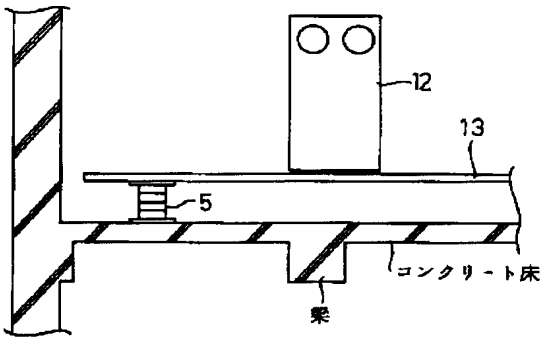
[Drawing 3]



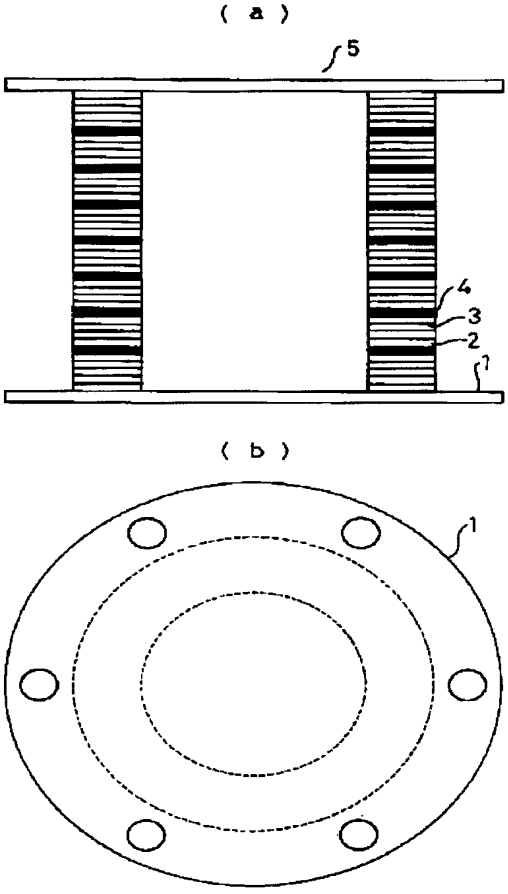
[Drawing 5]



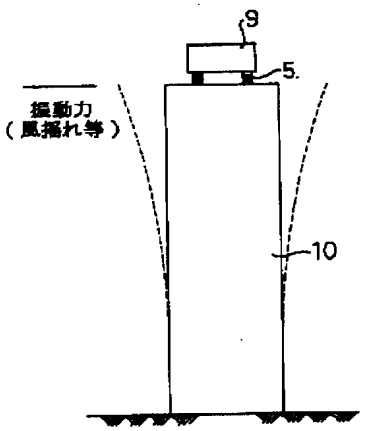
[Drawing 6]



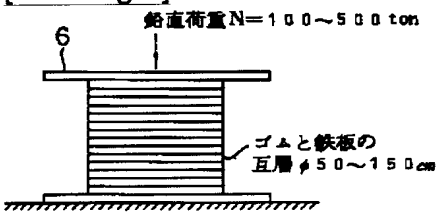
[Drawing 1]



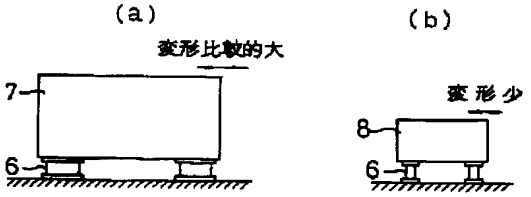
[Drawing 4]



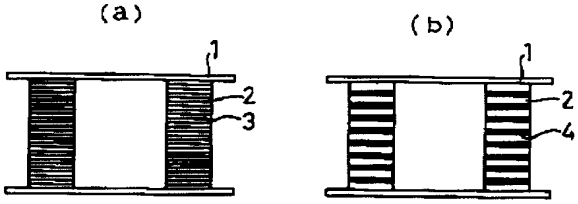
[Drawing 7]



[Drawing 8]



[Drawing 9]



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Ｆ１６Ｆ　15/04		9138－3Ｊ	Ｆ１６Ｆ　15/04	Ａ	

審査請求　未請求　請求項の数１　ＯＬ　（全４頁）

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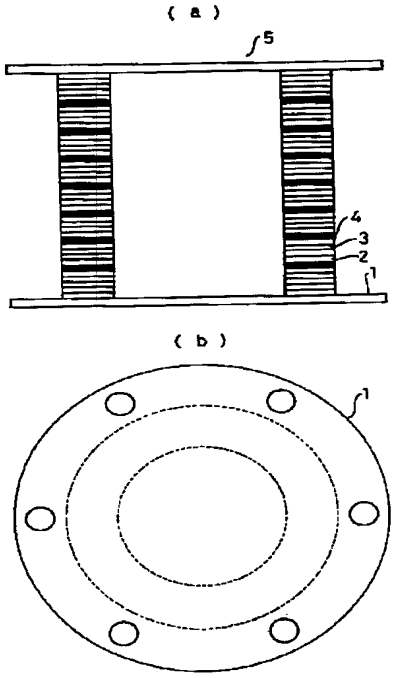
(54)【発明の名称】　フレキシブル支承

(57)【要約】
【目的】　鉛直耐力が高く、曲げ剛性も大きいが、剪断剛性は小さく、水平変形の大きい長周期の固有振動周期を持つフレキシブル支承を提供する。
【構成】　積層ゴム支承において、閉断面をなす内部中空の柱状に、薄いゴムと薄い鉄板を互いに積層したものを厚い鉄板で挟持して複数組積み上げ、該積層ゴムの上下両端に構造物に取り付け可能なエンドプレートを取着してなる構造とする。



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【特許請求の範囲】

【請求項１】　内部中空の閉断面を有する薄いゴム層と、同じく内部中空の閉断面を有する鋼板を互いに積層した柱状ゴム体に於いて、該積層鋼板のうち所定の間隔をおいて他層の鋼板より厚い鋼板を配列してなることを特徴としたフレキシブル支承。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、建築構造物、機械装置等の振動制御用の支持支承又は振動制御のための動吸振器を支持する支承に関する。

【０００２】

【従来技術及び発明が解決しようとする課題】従来、このような目的で積層ゴム支承が種々開発されている。（「開化宣言した”免震ビル”モデル施設がいっせいに登場」、日経アーキテクチュア１９８６年7月１４日号、第５４頁～第７５頁参照）従来の積層ゴム支承として最も一般的なものは、構造物に取り付けるための上下のエンドプレート間に、薄いゴムと鉄板を交互に積層挟持させたものがある。図７は、円筒形の内部充実型の従来のゴム支承の図である。しかし内部充実型の支承を用いて、重量荷重の大きい場合と同じ鉛直応力度で、木造建築構造物、機械装置或いは動吸振器等比較的軽量の構造物を支持しょうとすると、断面積の小さい小型の支承となり水平方向の許容変形量が小さくなる。図８（ａ）、（ｂ）は従来型積層ゴムで小型構造物を支持した場合の不都合点を示す図である。

【０００３】このように内部充実型のゴム支承を用いて軽量の構造物を支持すると水平方向の許容変形が小さくて、かつ長周期の固有周期を実現するには困難があった。

【０００４】そこで円筒形の内部を中空にして、水平方向の剪断剛性を小さくして、水平方向の変形能力を高めたものが開発された。図９（ａ）はリング状にゴムと鉄板を積層して内部を中空にしたゴム支承の基本的なものの図である。しかし内部を中空にした積層ゴム支承は剪断剛性は小さくなり、大きな変形能力を発揮するが、反面曲げ剛性と鉛直荷重耐力は低下し好ましくない。この問題を解決するため、例えば積層ゴムの上下方向中央部から上下方向両端にかけて、水平断面におけるリング巾を連続的に拡げ座屈し難いもの（特開平5-141463号公報）、或いは中空の積層ゴムを、接合プレートを介して、上下方向に複数組積み重ね、所定の低剪断剛性を得るもの（特開平5-141464号公報）等がある。しかし特開平5-141463号公報のものは、加工が複雑となり、特開平5-141464号公報のものは、径と高さのプロポーションが縦長となり、支承としての曲げ剛性の低下が懸念される。この他に挟持する鉄板の厚さを厚くする方法がある。この方法ではゴムの厚さが相対的に薄くなり、水平方向の剪断剛性が小さいと言う積層ゴムの本来の特性が

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失われて都合が悪い。そのままゴム厚を厚くしていけば支承の全高が高くなり、曲げ剛性が低下すると言う不都合を来す。図９（ｂ）は、挟持する鉄板の厚さを厚くした支承の図である。

【０００５】本発明は、このような問題点を解決するために工夫されたものである。

【０００６】

【課題を解決するための手段】内部中空の閉断面を有する薄いゴム層と、同じく内部中空の閉断面を有する鋼板を互いに積層した柱状ゴム体に於いて、該積層鋼板のうち所定の間隔をおいて他層の鋼板より厚い鋼板を配列してなることを特徴としたフレキシブル支承を主旨とする。

【０００７】

【作用】図１は本発明のフレキシブル支承を示す図である。

【０００８】厚い鉄板は、該支承全体の変形時に作用する応力伝達に関与し、薄い鉄板はゴム層を薄くするのに効果を発揮する。即ち厚い鉄板は断面の平面を保持し曲げ剛性を確保する一方薄いゴム層と薄い鉄板の互層は、鉛直方向の剛性を高め、水平方向の低い剪断剛性を実現する。

【０００９】図２は本発明のフレキシブル支承が水平変形する時の状態を示した図である。

【００１０】厚い鉄板の曲げ剛性が高く、薄いゴムと薄い鉄板の互層部分は剪断剛性が低いため該支承は全体的に平面を保持した形で水平変形を引き起こす。又、薄い鉄板でゴムが分割されているため支承の縦弾性係数が高く鉛直荷重耐力が向上している。この双方の作用によって、安定な荷重支持が実現する。

【００１１】図３は、中空でゴム層と薄い鉄板の互層からなる従来の支承が、水平変形する時の状態を示した図である。鉄板の剛性は低く、従って支承としての曲げ剛性が乏しく安定した荷重支持が困難である。又、鋼板の降伏も早期に起こるため耐力も低下する。

【００１２】

【実施例】以下図に基づいて本発明のフレキシブル支承を説明する。

【００１３】図１（ａ）は本発明のフレキシブル支承の立断面図であり、（ｂ）は上面図である。内部中空になるようリング状に薄いゴム２と薄い鉄板３を互層したものの上下を厚い鉄板４で挟んだブロックを複数組積み上げ、構造物に取り付け用の上下のエンドプレート１で、挟持した構造とする。

【００１４】例えば外径φ６００mm、内径φ３６０mm、ゴムの厚さ２～３mm、薄い鉄板の厚さ３～４mm、ゴムと薄い鉄板の互層ブロックの厚さ１５～２０mm、厚い鉄板の厚さ９～１２mm、全高１２００mmのフレキシブル支承で支承の縦弾性係数は約６００～７００Ｋｇ／ｃｍ^2 となり２５Ton の支持荷重に対して約２

cmの鉛直変形を起こすのみである。一方水平剛性は約５０～１００Kgf/cmであり支持荷重２５Ton に対して３～５秒の周期で支持することが可能である。又該フレキシブル支承の水平方向の変形量は±５０cm前後まで線形状態を保持し得ると考えられる。

【００１５】

【発明の効果】本発明によれば、厚い鉄板は、該支承全体の変形時に作用する応力伝達に関与し、薄い鉄板はゴム層を薄くするのに効果を発揮する。即ち厚い鉄板は鉛直荷重耐力と曲げ剛性を確保する一方薄いゴム層と薄い鉄板の互層は、大きな変形を許容するしなやかな剪断剛性を実現することが出来る。

【００１６】従って、比較的軽量の動吸振器（超高層建築物の振動制御装置）を３～５秒の固有周期を持つ系として実現でき、その変形能により振動エネルギを吸収するため、風揺れ等比較的長周期の振動の場合極めて有効である。図４は超高層建築物に設置した動吸振器に本発明のフレキシブル支承を応用した図である。

【００１７】又、従来不可能とされていた、木造建築物等の軽量建築物の免震支承としても剪断剛性が低いので十分応用できる。図５は、木造建築物に本発明のフレキシブル支承を応用した図である。

【００１８】又、本発明の支承は、機械機器を設置する床免震にも応用することが出来る。

【００１９】図６は、コンピュータ室等の床の免震に本発明の支承を応用した図である。

【図面の簡単な説明】

＊【図１】（ａ）は本発明のフレキシブル支承の立断面図であり、（ｂ）は上面図である。

【図２】本発明のフレキシブル支承が水平変形する時の状態を示した図である。

【図３】中空でゴム層と薄い鉄板の互層からなる従来の支承が、水平変形する時の状態を示した図である。

【図４】超高層建築物に設置した動吸振器に本発明のフレキシブル支承を応用した図である。

【図５】木造建築物に本発明のフレキシブル支承を応用した図である。

【図６】コンピュータ室等の床の免震に本発明の支承を応用した図である。

【図７】円筒形の内部充実型の従来のゴム支承の図である。

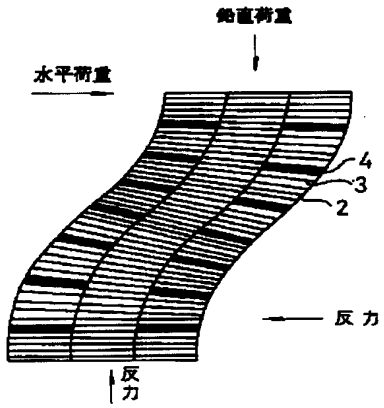
【図８】（ａ）、（ｂ）は従来型積層ゴムで小型構造物を支持した場合の不都合点を示す図である。

【図９】（ａ）はリング状にゴムと鉄板を積層して内部を中空にしたゴム支承の基本的なものの図である。（ｂ）は、挟持する鉄板の厚さを厚くした支承の図である。

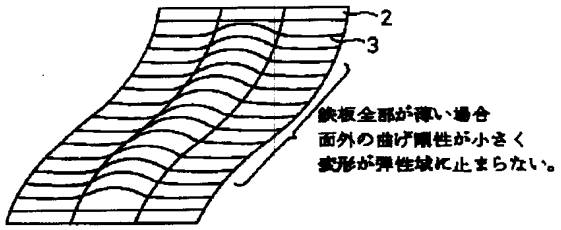
【符号の説明】

１・・・エンドプレート、２・・・積層ゴム、３・・・薄い鉄板、４・・・厚い鉄板、５・・・本発明のフレキシブル支承、６・・・従来のゴム支承、７・・・大型構造物、８・・・小型構造物、９・・・動吸振器、１０・・・超高層ビル、１１・・・軽量建物、１２・・・コンピュータ、１３・・・免震床

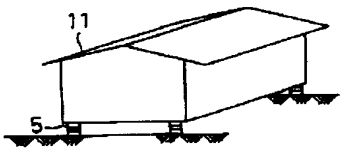
【図２】



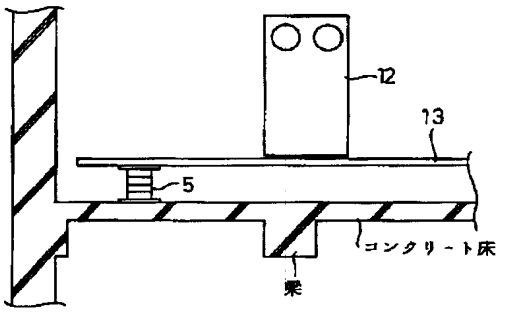
【図３】



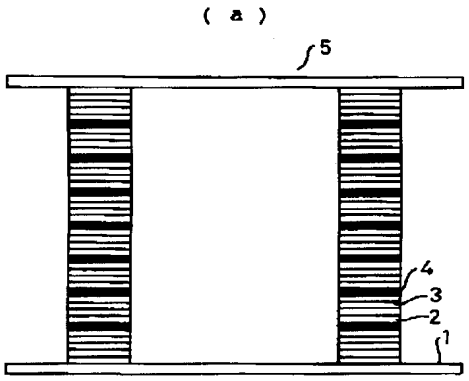
【図５】



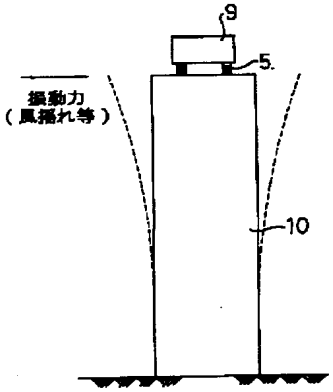
【図６】



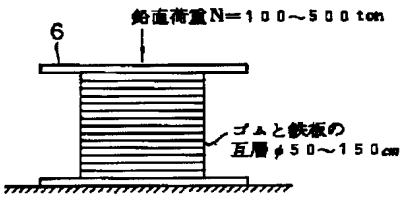
【図１】


(a)
5
4
3
2
1
(b)
1

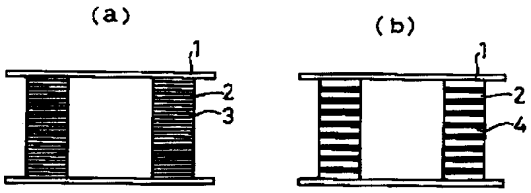
【図４】


9
5
振動力
（風揺れ等）
10

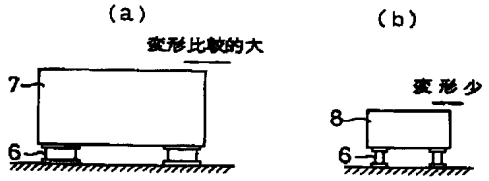
【図７】


6
鉛直荷重N＝１００～５００ton
ゴムと鉄板の
互層φ５０～１５０cm

【図９】


(a)
1
2
3
(b)
1
2
4

【図８】


(a)
変形比較的大
7
6
(b)
変形少
8
6